

**REMARKS**

By this Amendment, claims 2 and 3 have been cancelled without prejudice to or disclaimer of the subject matter contained therein; claims 1, 4 and 5 have been amended; and new claims 12-40 have been added, leaving claims 1 and 4-40 pending. Claims 4 and 5 have been amended to depend from claim 1 consistent with the cancellation of claim 2. Reconsideration of the July 16, 2003 Office Action is respectfully requested in view of the above amendments and the following remarks.

**1. Rejection Under 35 U.S.C. § 102**

Claim 1 stands rejected under 35 U.S.C. § 102(b) over U.S. Patent No. 4,225,462 to Umemura et al. ("Umemura"). The rejection is respectfully traversed.

Claim 1, as amended, recites a catalyst for decomposing an organic halide(s), which comprises "(a) 1 to 30 wt. % of water-insoluble vanadyl sulfate ( $\beta$ -VOSO<sub>4</sub>); (b) 20 to 70 wt. % of *at least one oxide comprising one of titanium and niobium*; and (c) 20 to 70 wt. % of at least one sulfate comprising at least one atom selected from the group consisting of calcium, barium, strontium, and lead, where (a) + (b) + (c) = 100 wt. %" (emphasis added). Support for the amendments to claim 1 is provided, for example, at page 9, lines 10-16; page 10, lines 5-9; and page 10, lines 16-22, of the specification. Umemura fails to disclose the combination of features recited in claim 1 for the following reasons.

Umemura discloses a catalyst for decomposing nitrogen oxides, which contains barium sulfate and vanadium(IV) oxide sulfate. Preferred amounts of barium sulfate and vanadium(IV) oxide sulfate in the catalyst are disclosed in the paragraph bridging columns

3 and 4 of Umemura. The catalysts described in Examples 1-11 of Umemura (columns 7-9) consist of *only* barium sulfate and water-insoluble vanadium(IV) oxide sulfate.

Umemura discloses that one or more vanadium compounds different from the vanadium(IV) oxide sulfate may be contained in the catalyst, but fails to disclose that the catalysts can contain "at least one oxide comprising one of titanium and niobium," as recited in claim 1.

Thus, because Umemura fails to disclose each and every feature recited in claim 1, claim 1 is not anticipated. Withdrawal of the rejection under 35 U.S.C. § 102(b) is therefore respectfully requested.

Furthermore, the catalyst recited in claim 1 would not have been rendered obvious by Umemura. First, Umemura fails to provide any suggestion or motivation to modify the catalyst to further contain "at least one oxide comprising one of titanium and niobium," as recited in claim 1. Second, Applicants have attached a Declaration Under 37 CFR 1.132 by Nobuhiko Horiuchi, an employee of Mitsui Chemicals, Inc, which provides comparative evidence that supports the un-obviousness of the claimed catalyst. As described in the Declaration, Catalyst A according to an exemplary embodiment of the claimed invention and comparative Catalyst B were prepared and tested. Catalyst A contained 9 wt. % of water-insoluble vanadyl sulfate ( $\beta$ -VOSO<sub>4</sub>), 59 wt. % of titanium oxide, and 32 wt. % of barium sulfate. Catalyst B contained 7.5 wt. % of water-insoluble vanadyl sulfate ( $\beta$ -VOSO<sub>4</sub>), and 92.5 wt. % of barium sulfate, i.e., it did not also contain titanium oxide.

Catalysts A and B were tested by a MCB (monochlorobenzene) decomposing test using a model gas containing 10 vol. % of oxygen and 90 vol. % of nitrogen, which further



contained MCB. The MCB decomposition rate results are shown in TABLE 1 of the Rule 132 Declaration. The test results reveal that Catalyst A provided an MCB decomposition rate of 87.6%, while Catalyst B provided a much lower rate of only 26.2%.


These test results demonstrate that a catalyst composition according to an embodiment of the claimed catalyst, which includes a combination of vanadyl sulfate ( $\beta$ -VOSO<sub>4</sub>), barium sulfate and titanium dioxide within the ranges recited in claim 1, provides an unexpectedly improved decomposition rate for organic halides as compared to the comparative catalyst, which did not include the claimed combination of components.

It is respectfully submitted that the claimed catalyst also would not have been rendered obvious by Umemura.

**2. Rejection Under 35 U.S.C. § 103**

Claims 1-11 stand rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 4,378,338 to Imanari et al. ("Imanari"). Claims 2 and 3 have been cancelled. The rejection is respectfully traversed.

Imanari discloses a catalyst for removing nitrogen oxides from waste gases containing nitrogen oxides and oxygen in the presence of ammonia. The catalyst contains at least titanium, vanadium and magnesium. Imanari's preferred catalyst composition range is, in atomic %: titanium not less than 50%, but less than 98%; vanadium not less than 0.1%, but less than 50%; magnesium not less than 1%, but less than 50%; and tungsten not less than 0%, but less than 50% (column 2, lines 60-67). Imanari further discloses a preferable composition as one atom of titanium, 0 to 1 atom of tungsten, 0.01 to 0.6 atom




of magnesium and 0.001 to 1 atom of vanadium (column 3, lines 15 to 20). In the catalyst, titanium and tungsten are provided as oxides, and magnesium and vanadium are provided as oxides and/or sulfates (column 3, lines 33-36). Imanari discloses that the catalyst is a "specified catalyst" for the purpose of removing nitrogen oxides (column 1, lines 12-21), and that "the catalyst of the present invention is remarkable in effect when used in *the specified composition range*" (column 2, lines 60-61; emphasis added).

Imanari further discloses that in addition to the metal components A, B and C, the catalyst can contain other components, such as Cr, Ca, Ba, Sr and Pb in an amount of 1 wt% or less; and sulfates of Zr, Nb and Mo in an amount of 3 wt% or less (column 5, lines 33-46).

In contrast to Imanari's catalyst composition, in the catalyst recited in claim 1, the oxide of niobium is contained in an amount of 20 to 70 wt. %; Imanari's disclosed amount is 3 wt. % or less. Also, the catalyst recited in claim 1 contains 20 to 70 wt. % of at least one of the sulfates of calcium, barium, strontium and lead; Imanari's disclosed amount of these components is 1 wt. % or less. Thus, Imanari's catalyst composition is different from that of the claimed catalyst.

Also, Imanari does not suggest that the catalyst is suitable for decomposing organic halides. Imanari very generally mentions that the catalyst "find use in a widespread range of applications to various waste gases" (column 4, lines 32-33). However, Imanari does not suggest that such "various waste gases" include organic halides. Also, Imanari discloses that the above-described catalyst composition "is remarkable in effect when used



in the specified composition range" *for treating nitrogen oxides*. In other words, the catalyst composition is designed specifically for treating nitrogen oxides. Imanari does not suggest that the catalyst of the specified composition range might also be effective to decompose organic halides, especially in light of the unpredictable nature of catalysts.

For the foregoing reasons, it is respectfully submitted that the catalyst recited in claim 1 would not have been *prima facie* obvious over Imanari.

Claims 4-11 depend from claim 1 and also are patentable over Imanari for at least the same reasons as for claim 1. Regarding method claims 8-11, Umemura does not suggest decomposing an organic halide "by contacting a gas containing an organic halide(s) with the catalyst described in claim 1 to decompose the organic halide(s)." Imanari discloses a catalyst composition designed specifically to treat nitrogen oxides, and does not suggest the claimed method that uses a different catalyst composition to decompose a different substance.

Therefore, withdrawal of the rejection is respectfully requested.

### **3. New Claims**

Claims 12 and 13 depend from claim 1 and, accordingly, also are patentable.

Independent claim 14 recites "a method of decomposing at least one organic halide, comprising contacting a gas containing at least one organic halide with a catalyst comprising water-insoluble vanadyl sulfate ( $\beta$ -VOSO<sub>4</sub>)." It is respectfully submitted that the method recited in claim 14 also is patentable.



Claims 15-40 depend from claim 14 and, accordingly, are also patentable for at least the same reasons as for claim 14.


For the foregoing reasons, Applicants respectfully submit that the application is in condition for allowance and such action is earnestly solicited.

Respectfully submitted,

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